Awareness and Adoption of University Smart Card: The Case of UUM

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Abstract

Smart cards are widely used for several applications. Education environments offer the best opportunities for the adoption of smart cards technology. Therefore, this study is interested to assess the awareness and adoption towards the current and future of smart card applications in university. The study focused on Universiti Utara Malaysia (UUM) since UUM was the pioneer adopter and implementer of smart card among universities in Malaysia. This study was conducted to identify the awareness and adoption of the current applications of university smart cards. Additionally, this study distinguished respondents' preferences for future applications of university smart cards in order to optimize the adoption process. Data were gathered through questionnaires that have been distributed to the UUM staffs. All the collected data were analyzed using descriptive analysis. Results have shown that most of the respondents were aware of the smart card applications and identified which application that is the most aware of. The results have shown that respondents were aware and adopt similar applications. Nevertheless, even though the respondents were aware of the smart card applications, they do not fully adopt and use them. This study has also identified what applications that respondents prefer to be enhanced and continued in the future smart card.

Keywords: Awareness, Adoption, Smart Card Applications

1. INTRODUCTION

Smart card is one of the technologies that are able to store and protect relatively large amounts of data (Fowler, Swatman & Welikala, 2000). In addition, they also have the ability to use the same card for multiple services and multiple service-providers (Kaur, 2002). Thus this single card has the potential to replace all the cards carried in the wallet (Welikala, Fowler & Swatman, 1997). It can simplify the environment by eliminating cash-handling and paperwork problems with some security features.

Many colleges and universities are moving on the implementation of the smart card, not because a smart card is similar with a credit card but because of its convenience and new trend of lifestyle (Kaur, 2002). According to Welikala, Fowler & Swatman (1997), most of the smart cards benefits are especially relevant to university because of the environments in which there are many uses for it. Many of the three million smart cards in use in the United States today are in use at university campuses (Peterson, 1999). According to Taneja (1999), College and University campuses have and university campuses have proven very

successfully environments for community wide adoption of smart-card technology and we can learn from their experience.

University Utara Malaysia (UUM) was the pioneer adopter and implementer of smart card among universities in Malaysia (Malar). Percetakan Nasional Malaysia Berhad (PNMB) was the first project which introduced smart cards in UUM. This project was approved on 23 July 1995 and was implemented since December intake 1995/96 session. However, the number of student utilizing smart cards was only 93 and the usage is limited to only as a matric card which stores personal information, library card, computer lab booking and staff attendance record. The application of the smart cards was fully implemented to all students beginning May intake 1996/97 and January 1998 for the staffs.

The second project was introduced by Affin Bank known as Kad Pintar UUM (KPU). The KPU was implemented as a student matric card and staff identification card. This smart card consists of three applications; Attendance System for staff, Library System and Clinic System in Pusat Kesihatan Pelajar UUM. The latest smart cards are produced by Bank Islam Malaysia Berhad and Modular Corporation Sdn. Bhd. known as Universiti Utara Malaysia Multi-Purpose Card (UMPC) which consists of two major applications; University Applications and Banking Applications.

This study explores the applications of smart cards in the Malaysian university, Universiti Utara Malaysia. This involved investigating the response of staffs towards the awareness and adoption or the intention to use the technology of university smart cards. Studying the experiences gained by UUM staffs using smart cards application in the university provided an insightful picture for university to consider adopting such technological innovation.

2. PROBLEM STATEMENT

Malaysia is in the forefront in the adoption of smart cards in the Asia Pacific region, nevertheless they are still far from taking full advantage of the smart card technology and its uses. In terms of adoption, Malaysia is fast but in the view of the end-users, there is still a lack of awareness and knowledge in terms of full usage of the smart cards. While the general population is using the MyKad, only 10 percent of its holders use the other applications that come with the identity card. Thus, what deters the smart cards such as the MyKad from being used beyond their main purpose is education. There should be more educating going on in the use of smart cards and in terms of their application so that more people will be appreciative and receptive towards the technology. The necessary steps are needed to educate people about the use of smart card technology. The Smart Card system can be used to help people make their lives easier, and as the awareness about this system grows, people will look forward to adopt it in future, and at the same time enjoy the various benefits that the system provides. To become adaptive, applications first need to be aware of computing environment characteristics and their changes.

3. OBJECTIVE

This study attempts to achieve the following objectives:

- To identify the awareness of the current applications of university smart cards.
- To identify the adoption of the current applications of university smart cards.

- To identify the users' preferences for future applications of university smart cards in order to optimize the adoption process.

4. SIGNIFICANCE OF THE STUDY

The motivation to carry out this study is due to the previous studies conducted by Lee, Cheng and Depickere (2003), Weilaka, Fowler and Swatman (1997) and Fowler, Swatman and Welikala (2000) which focused on the university smart card in Australia and Singapore.

These studies have motivated us to explore the adoption of smart cards and the preferential use of the smart cards among the users in Malaysian universities specifically in UUM. This is because, through the extent of knowledge and literature review, there is no research that has been done on smart cards and the applications of the smart cards in Malaysia. Thus, there is no feedback on the implementation of the smart cards and no evidence of the efficiency and the effectiveness of smart cards.

The findings from this study have contributed to the descriptive information on the current awareness and adoption and future preferences of smart cards in UUM. Results of this study might help the service providers especially the universities or any educational institutions to start thinking the ways and means to implement the smart cards in their daily administrative, management and academic operations.

5. LITERATURE REVIEW

A. Smart Card

Smart cards were invented 33 years ago by Roland Moreno in France in 1974. The technology was first introduced to reduce prodigious amount of theft and fraud involved in the telecommunications industry (Kemier, 2002). For a long time, it has been difficult for companies to justify issuing smart cards instead of magnetic stripe card (Trask & Meyerstein, 1999).

Smart cards grew slowly but steadily for several years. It was used in many countries and their acceptances are expected to grow dramatically in most sectors of the public and private. It is now making a leap into a various application areas including access control, security, entertainment and leisure, access to financial services, health care services, retail or utilities, transport, telecommunications and as an electronic wallet (Fowler, Swatman & Welikala, 2000).

Smart cards have been around for more than (according to paragraph 1 of lit review) 20 years, but only in recent years they have started to be used more widely by the consumers throughout the world. These cards are commonly used in Europe, particularly in France and England; however their acceptance in the United States has been more tepid (Bull, 1999). In Asia, the highest adoption of smart cards are in Hong Kong, Taiwan, Singapore, Malaysia, Japan and Korea, where the cards are used largely for transit, payphone and e-cash schemes (Leng, 1999).

Smart cards are continuously introduced into different areas of life around the globe. There are various application of smart cards intrusion into our lives such as finances, telecommunications, health care, mass transit systems and contactless smart cards, loyalty programs, identification and security, student cards and government. To various degrees, all applications can benefit from the added features and security that smart cards provide. Smart cards have been applied to a variety of functions, including the identification of the card-holder; the authentication of card-holder's authority to conduct a transaction, the transaction itself and the data representing the transaction; the encryption and decryption of messages; data storage and data (Clarke, 1998).

These smart cards have been used in or proposed for a variety of settings, including financial applications of a number of different kinds such as debit cards (payment against the account-holder's own funds); credit cards (payment against a line of revolving credit); account charging (e.g. for telephone calls and pay-television, and for tele-banking and tele-shopping); and frequent buyer schemes. It also can be functioned as an 'electronic cash' for low-value payments, referred to as 'tokens', 'pre-paid cards', or an electronic wallet or purse. Security accessibility to buildings and sites, sensitive data and data processing functions, account ownership and access (e.g. for video text and e-mail) are also potential functions for smart cards. It also can be used to control the adoption and charging for the road and parking-site and organisational membership. Using the smart card in the health care and tourism sector could be more value added and competitive.

Smart card offers varieties of advantages through the magnetic-stripe technology. It considers greater security and the ability of the card to check the authenticity of devices it communicates. It also has greater storage capacity than that available with conventional magnetic-stripe technology; and the ability to provide services from a standalone unit, which is not, or is only infrequently, connected to the service's host machine (Clarke, 1998).

B. Awareness and Adoption

Wang, Q. and Cheng, L. (2004) define awareness as the information of computing environment characteristics that are needed to perform adaptations. Adaptive applications are not only interested in their own awareness information, but also the awareness of their peers. Wang, Q. and Cheng, L. (2004) also summarized the types of awareness which includes user awareness, application awareness, network awareness, device awareness and environment awareness. User awareness measure the user's high level expectations of a service by specifying their preferences. In a pervasive computing environment, the inequity of the devices and networks in a system requires an application to know its peer's awareness in order to make a proper adaptation decision.

Adoption is the decision to use or accept a particular idea. According to Hui Min Lee, Catherine; Wing Cheng, Yuk; Depickere, Arnold (2003), in order to insure adoption, it is important to guarantee that the university smartcards are socially acceptable and fit well with the norm and environment. Hence, manufacturer or service providers should take note of the ranking of user preference when designing a university smart card in order to optimize the adoption of the smart card technology.

One of the important things to be considered is to increase users' awareness of the smart card and its advantages (Adel Ismail Al-Alawi and Mohammed Ahmed Al-Amer, 2006). Widespread the smart card awareness, education and training are the critical success factors

to enforce the adoption of the smart card technology. Adel Ismail Al-Alawi and Mohammed Ahmed Al-Amer (2006) recommend some efforts to be included in increasing the awareness such as develop a nation wide campaign to promote the new smart card for different community segments; using newspapers, road banners, television, Internet and other medias to convey information about the smart card; more press conferences and visit to schools and universities to enlighten the young generation to use the smart card; provide guidelines for the usage and advantages and provide the services of issuing the cards in place of work in significant corporations, governmental organizations, private and public schools; and universities.

C. Malaysia Multipurpose Card

The Malaysian Government in co-operation with financial institutions has introduced a multipurpose card (MPC) in Malaysia (Ronay, 2001). Malaysia is not only the first country in Asia Pacific to have rolled out the implementation of a multipurpose digital application card, MyKad, but it was also the first to fully migrate to EMV chip-based card for its banking sector at the end of 2003. The initial applications identified for inclusion on the MPC by the year 2000 include a number of existing and new government and financial applications. These applications are:

- Electronic Cash (E-cash) with stored-value application that can be either anonymous or account linked. E-cash would be issued by individual financial institutions and would be fully auditable. It would be the first Government supported national E-cash programme. The E-cash platform would form the base for the other Smart Card projects.
- National ID with enhanced security through chip technology and biometrics identification. This application is the anchor for the Government MPC because of its widespread use and common data set that could be shared with other government applications. The ID number will also serve as an access key to facilitate secure development to other Government and private applications that do not require dedicated chip space.
- Driving Licence with enhanced functionality, including a record of outstanding traffic violations to enhance enforcement.
- Immigration functions as a passport supplement to facilitate efficient entry and exit to the country.
- Medical application containing basic medical information to improve diagnosis and delivery of card in emergency and general care situations.
- Debit applications issued by individual financial institutions that are internationally accepted and provide enhanced security.
- Automatic Teller Machine (ATM) application issued by individual financial institutions that is internationally accepted and provides enhanced security.
- Credit application issued by individual financial institutions that is internationally accepted and provides enhanced security.

These all applications will share the common MPC platform, it is envisioned that these applications is combined to form a variety of card combinations that meet the requirements of consumers, Government agencies and financial institutions. Three types of card structures are accommodated in the initial development of the MCP platform:

- Government Multipurpose Card (Government MPC): combining national ID, driving licence, medical, immigration application and optional E-cash.

- Payment Multipurpose Card (Payment MPC): accommodating international credit, debit, ATM and E-cash. Payment MPCs is individually issued and branded by issuing banks.
- Disposable E-cash Card: E-cash applications and infrastructure shall e compatible with a disposable E-cash card. The Payment consortium shall issue this card.

D. Smart Card in Universities

Colleges and universities are the pioneer smart cards applications with their closed campus communities (Zalud, 2000). Over time the University in common with many similar organizations had introduced cards for a variety of different purposes called smart cards. The contributions of smart cards in universities are to organize and transfer information, simplify and accelerate operations such as organization of student data (personal, educational, financial and others), organization of teaching staff data (position of the staff, salary status, authorities and activities), organization of the administrative personnel data (working position, salary status, holidays and overtime) and access to other facilities or services offered by the institute (libraries, university club, student dormitories and others) (Lambrinoudakis, 2000).

As a result most of the students and staffs carried up to five cards for one purpose or another such as library cards, student identity cards, cards for electronic access control to buildings and secure locations, cards for vending which is typically for photocopying, telephone cards, sports hall passes and computer users cards (Burbridge, 1998). In addition there is another study on applications of smart cards in university act as multi-purpose, multi function and smart ID card which have additional of applications such as which also support banking and electronic wallet facilities in both on and off-campus shops such as grocery, fuel, bills, entertainment, transactions with machines, cafeteria, transport, tuition, medical, books and stationery and University Financial Aid Program (Welikala, Fowler & Swatman, 1997).

The use of magnetic and smart cards in European and American Universities has grown steadily over the past five years (Welikala, Fowler & Swatman, 1997). In 1994, Florida State University, USA introduced the first smart ID card and there are now over 200 universities and colleges in the USA alone with magnetic or smart cards schemes. Penn State is the first campus to have multiple until five bank accounts involved. (Orla, 1999).

E. Smart Card in Malaysian Universities

Multimedia Media University (MMU) issued smart cards for staff and student not only as an Identification Card, but also as a pay card. The MMU smart card consists of personal data of each staff or student in detail. Each staff or student loads cash from account in Bank Bumiputra Commerce to the smart cards through Unattended Loading Device (ULD), which is installed in MMU Campus with the usage of pin number or through their personal computer. The accounts holder needs to install the software and card slot for the purpose. The smart cards applications comprise of Touch & Go Card, Medical Card, ATM Card (MEPS Card), Telekom Card (Telekom), Key to your Door (Access Control), Your Wallet (e-purse) and University applications (Adika Shiraz & Noor Raihan,2000).

International University College of Technology TwinTech in Damansara, Kuala Lumpur has applied successfully the Enterprise Resources Planning (ERP) solution and smart cards access system. Perspective Globe Sdn Bhd has invested RM1.7 million to develop the "Total

Smart Campus Solution" (TSCS), a combination of e-University or College ERP solution and integrated with a Smart Card Access System by IBS Technology Sdn Bhd. The web enabled ERP solution which provide for online operations and transactions on a central database would enhance the efficiency of departments within a campus, its management, lecturers, supporting personnel and students. The smart application and security access system which includes Smart Card Cyber Café System, Smart Card Library System, Smart Card Photocopier System, Smart Card Door or Turnstile Access System and Smart Card PC Access System.

F. Smart Card in Universiti Utara Malaysia

The UMPC benefits the UUM and staff through its multi purpose feature which consist of two major applications; University Applications and Banking Applications.

University Applications
The university applications consist of multi information such as personal information, academic information and medical information. Other applications are interface to library system, security access, attendance record and parking system.

Banking Applications
This application contains 3 applications which are ATM, e-Debit, and MEPS Cash. The ATM applications allows users to make various transactions, such as cash withdrawal, fund transfer, statements request, utility bills payment, zakat payment, deposit to Tabung Haji, contribution to Yayasan Ekonomi Islam Malaysia, internet banking (bankislam.biz) registration, Personal Identification Number (PIN) change and MEPS inquiry and loading. While e-Debit is a service where consumer pays their purchases using UMPC and PIN and the electronic funds are transferred to the point of sale. The purchase amount is deducted directly from either their Savings or Current Account. The other application is MEPS Cash or an e-purse application which stores a specific amount of monetary value loaded from ATM account, which can be used to make routine daily small purchases.

Currently, the library system, clinic system and e-purse or e-cash has been fully implemented and can be used by the staffs and students but the attendance system has only been implemented for the staffs to punch in and punch out of their daily attendance. For the students, the usage of smart card is mainly to retain their account with Bank Islam as the money for their study loan PTPTN is being paid through the account. They can withdraw or deposit their money to any ATM not only in UUM Campus but also to all ATMs which have MEPS or BANKCARD sign in Malaysia. UUM's implementation of the e-cash applications in campus creates a cashless society. Currently, all of the 23,000 students and staffs in UUM are able to use the e-cash application on 71 business premises at 81 terminals around the campus such as cafeterias, mini market, Koperasi shops and Unishoppe and 12,000 other outlets in Malaysia such as book shops, petrol stations and restaurants.

Bank Islam Malaysia Berhad (BIMB) has provides 192 BIMB ATM machines to load the MEPS CASH value through 4,000 ATM machine (MEPS) in Malaysia. Besides the MEPS CASH, there are 11 ATM (MEPS) around the campus in Varsity Mall, Kolej Bukit Kachi, Kolej Yayasan Al-Bukhary, Pusat Konvensyen and Pusat Kegiatan Pelajar that can be used to load the value of money in the e-cash card. Users can transfer money from their account to the MEPS CASH through any ATM machine with the minimum value of RM10.00 and the maximum value of RM2000.00. Users of the smart card or Bankcard can utilize the e-cash

application on any counter in Malaysia that offers MEPS CASH application. In addition, this application is not only limited to UUM or staffs but it is open to anyone who has a Bankcard from any local bank.

The latest application of the university's smart card is a new bus system which was launched on January 1st 2007 and is known as the Prepaid System. UUM has decided to abolish the Bus Service Fee of RM42.00 per semester which was previously included in students' semester fees. Consequently, students are required to utilize their Students' Matric Card to pay for their bus rides, from on point to another in Campus. For every ride, 40 cents is charged regardless of the destination. The amount of 40 cents is equivalent to 1 (one) point. The point is deducted from the total balance point and the balance is displayed on the screen reader every time the card is accessed to the reader.

Students can purchase the prepaid point of RM8.00 equivalent to 20 points or RM16.00 equivalent to 40 points or RM32.00 equivalent to 80 points. The prepaid point can be purchased at DKG 2, Varsity Mall Sales Counter, Bukit Kachi Mall and at the Bank Muamalat College. The payment is made through e-pay system where no cash payment is allowed and the point value is loaded in the Matric Card. Students can top up the amount using any ATM Card (Bank Islam, Maybank, Hongkong Bank, Public Bank, Affin Bank, RHB Bank, Lion Bank and AM Bank and Eon Bank) where they are required to present both their ATM Card and Matric. However, in the whole month of January 2007, cash payment is accepted only at the Bank Islam UUM Branch. Since the point value is deducted for every service used, when there is a balance at the end of semester, the point value will be carried forward to the next semester.

6. METHODOLOGY

Article I: Data Collection

This study was carried out through survey approach. The population of this study consisted of 2,241 UUM staff including academicians (902) and non- (1,339). In order to obtain a representative data from the population under study, the sample size depends on the basic characteristics of the population, the type of information required from the survey and the cost involved.

Churchill (1999) provides a typical sample size and the acceptable sample size for this study was 50-200 as shown in Appendix 1. Hence, the questionnaires were distributed randomly to the 200 respective respondents throughout the directories of staffs. The total questionnaires that have been returned and analyzed in this study were 159 questionnaires. The questionnaire comprised of two parts as in Appendix 2, where Part 1 includes the opinion about smart card, level of awareness and usage or adoption of the smart cards applications in UUM while Part 2 is about respondent's profile and background.

Article II: Data Instrument

The questionnaire used 5-point Likert-based rating scales. Part 1 consists of the applications of Smart Card in UUM where respondents gave their opinion on the smart card itself; from strongly agree to strongly disagree. Respondents ranked their level of awareness from very familiar to don't know level, to test the degree of staffs' familiarity with the smart card

applications. Respondents also rank their level of smart card usage from very often (almost daily) to never (never use) to test the frequency of the smart card usage. Part 2 of the questionnaire gathers information on the profile and background of the respondents.

Article III: Data Analysis

This study used descriptive analysis where data from 159 questionnaires were analyzed where frequency test was used to describe the level of awareness and adoption towards the UUM smart cards and the respondents' profile. In addition, mean analysis was also used to measure the level of respondents' awareness and adoption towards the UUM smart card. The instruments were pre-tested where questionnaire needs to be refined before data collection is carried out (Dillman, 1978). The reliability test showed Cronbach's alpha of 0.940 which is acceptable according to Sekaran (2003).

7. FINDINGS AND DISCUSSIONS

This study shows that all respondents have their own smart card except for one respondent who was on contract basis and most of the respondents (83.6%) opened their account in Bank Islam Malaysia Berhad (BIMB).

Table 1: Opinion on the applications of Smart Card in UUM

	Statements	Percent					Mean
		Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree	
i	Aware of the university applications.	28.9	49.7	13.8	5.7	1.9	3.98
ii	Aware of the banking applications.	27.0	48.4	15.1	7.5	1.9	3.91
iii	Smart card applications are important.	27.0	42.1	23.9	6.9	0.6	3.89
iv	Smart card applications are sufficient.	9.4	39.6	34.6	14.5	1.9	3.40
v	Smart card is convenient.	21.4	60.4	12.6	5.0	0.6	3.97
vi	Smart card reader is convenient.	17.6	54.7	17.6	7.5	2.5	3.77
vii	University continue smart card applications.	39.0	45.9	8.8	4.4	1.9	4.16
viii	University enhance smart card applications.	39.0	45.9	8.8	4.4	1.9	4.22
ix	Applications in future smart card.						
	a. Cafeterias	18.2	39.0	17.6	18.9	6.3	3.44
	b. Car Washes	13.2	27.0	28.3	23.3	8.2	3.14
	c. Laundry Service	13.2	35.2	23.9	18.9	8.8	3.25
	d. Vending Machine	14.5	41.5	19.5	18.2	6.3	3.40
	e. Security Access	26.4	47.8	13.2	7.5	5.0	3.83
	f. PC Login Access	27.7	53.5	6.9	6.3	5.7	3.91
	g. Parking System	19.5	38.4	18.9	15.1	8.2	3.46
	h. Students Election	25.2	42.1	15.1	10.1	7.5	3.67
	i. Summon Check	22.6	52.2	13.2	8.2	3.8	3.82

The result of the study in Table 1 was very positive, it shows and concludes that respondents were aware and realized the importance of the smart card applications where the mean shows

3.8 above. However there are still few respondents who were not aware of the smart card applications. Furthermore, the respondents agreed that the smart card and the reader are convenient to use, where the means is 3.7 above, but they do not agree that the smart card applications are sufficient enough, with the means is below than 3.5. The result also shows that most of the respondents agreed that university should continue and enhance the smart card applications. The top ranking of the application that should be enhanced were PC login access followed by security access and summon check.

Table 2: Awareness of the Smart Card Applications

Applications	Percent					Mean
	Very familiar	Quite familiar	Indifferent	Unfamiliar	Don't Know	
University Applications						
(a) Personal Information	29.6	40.3	11.3	10.1	8.8	3.72
(b) Medical Information	19.5	34.6	23.9	13.8	8.2	3.43
(c) Attendance Record	61.0	28.9	4.4	3.8	1.9	4.43
(d) Library Systems	38.4	39.6	12.6	5.7	3.8	4.03
(e) Security Access	17.6	37.7	19.5	15.7	9.4	3.38
(f) Computer Lab System	8.8	32.1	25.8	21.4	11.9	3.04
(g) Parking System	3.8	13.8	32.1	23.9	26.4	2.45
Banking Applications						
(a) Cash Withdrawal	54.7	28.9	4.4	6.3	5.7	4.21
(b) Fund Transfer	36.5	30.8	14.5	12.6	5.7	3.80
(c) Statement Request	39.6	26.4	13.2	13.2	7.5	3.77
(d) Bills Payment	27.0	27.7	20.1	15.7	9.4	3.47
(e) Zakat Payment	13.2	23.3	30.8	18.2	14.5	3.03
(f) Deposit Tabung Haji	13.8	23.3	29.6	18.9	14.5	3.03
(g) Contribute to YPEM	7.5	17.6	34.6	18.9	21.4	2.71
(h) Internet Banking Registration	24.5	26.4	22.6	15.7	10.7	3.38
(i) SMS Banking Registration	18.9	25.2	27.0	16.4	12.6	3.21
(j) PIN Change	37.7	34.6	13.8	6.9	6.9	3.89
(k) MEPS Cash Inquiry and Loading	33.3	31.4	15.7	12.6	6.9	3.71
(l) e-debit	20.1	28.3	27.0	13.8	10.7	3.33
(m) MEPS Cash	44.0	32.7	13.8	3.1	6.3	4.05

Table 2 above presents the frequency of the respondents' awareness of smart card for each application. The applications are divided into two categories which is university applications and banking applications. The applications that respondents most aware are attendance records followed by library systems and personal information. The mean of the awareness for the other applications are above than 3.0. Furthermore, for the banking applications, respondents are most aware of cash withdrawals, followed by MEPS cash, PIN change and fund transfer.

Table 3: Usage of the Smart Card Applications

Applications	Percent					Mean
	Very often	Quite often	Often	Occasionally	Never	
University Applications						
(a) Personal Information	19.5	12.6	11.3	19.5	37.1	2.58
(b) Medical Information	8.8	12.6	17.0	27.7	34.0	2.35
(c) Attendance Record	71.1	13.8	7.5	3.1	4.4	4.44
(d) Library Systems	18.9	18.9	18.9	22.0	21.4	2.92
(e) Security Access	6.9	15.1	13.2	25.2	39.6	2.25
(f) Computer Lab System	2.5	9.4	13.8	20.1	54.1	1.86
(g) Parking System	1.9	4.4	4.4	13.8	75.5	1.43
Banking Applications						
(a) Cash Withdrawal	37.7	17.6	13.8	3.8	27.0	3.35
(b) Fund Transfer	11.3	15.7	13.2	15.7	44.0	2.35
(c) Statement Request	12.6	14.5	12.6	17.6	42.8	2.36
(d) Utility Bills Payment	8.2	10.1	10.1	18.9	52.8	2.02
(e) Zakat Payment	2.5	4.4	10.7	14.5	67.9	1.59
(f) Deposit Tabung Haji	3.1	3.8	12.6	14.5	66.0	1.64
(g) Contribute to YPEM	1.9	2.5	7.5	12.6	75.5	1.43
(h) Internet Banking Registration	8.2	8.2	13.2	18.2	52.2	2.02
(i) SMS Banking Registration	8.8	6.3	13.2	15.7	56.0	1.96
(j) PIN Change	10.7	13.2	10.7	27.0	38.4	2.31
(k) MEPS Cash Inquiry and Loading	11.3	15.7	18.9	14.5	39.6	2.45
(l) e-debit	7.5	9.4	12.6	13.2	57.2	1.97
(m) MEPS Cash	20.1	11.9	17.6	13.2	37.1	2.65

Even though the respondents are mostly aware of all the smart card applications, this does not mean that they use or adopt all of those applications. Table 3 shows the respondents' awareness; it shows whether there is a relationship between the level of the awareness and adoption of the smart card applications by looking at the frequency of use for each application. The result shows that the mean for attendance record is above 4.0 which signify that it is still the first application used very often by most of the respondents. Nevertheless, although the respondents are aware of the other applications, this study shows that there is no relationship between awareness and adoption as the mean for the other applications is below than 3.0 except for attendance record.

The adoption of banking applications can be concluded by the result of the frequency of use for each application. This study illustrates that the applications that the respondents use most is cash withdrawal. The other applications seem to have the same result with the university applications where the mean of the frequency of use is below than 3.0. This indicates that although respondents are aware of the applications, most do not use or adopt those applications.

Table 4: Profile and Background

	Variables		Frequency	
			N	%
1.	Gender	Male	58	36.5
		Female	101	63.5
2.	Age	Below 20	1	0.6
		21 – 30	78	49.1
		31 – 40	63	39.6
		41 – 50	13	8.2
		Above 50	4	2.5
3.	Staff Category	Academician	105	66.0
		Non-Academician	54	34.0
4.	Academician Level	Professor	1	1.0
		Associate Professor	2	1.9
		Senior Lecturer	5	4.7
		Lecturer	89	84.8
		Tutor	8	7.6
5.	Non-Academician Level	Professional and Management	9	16.7
		Supporting Staff	45	83.3
6.	Status of Designation	Permanent	143	89.9
		Temporary	15	9.4
		Contract	1	0.6
7.	Working Experience	Less than 1 year	10	6.3
		1 – 3 years	27	17.0
		3 – 5 years	59	37.1
		5 – 10 years	41	25.8
		More than 10 years	22	13.8
8.	Education History	IT background	50	31.4
		Non IT background	109	68.6

Table 4 shows that more than half of the respondents were female (63.5%) while the rest are male (36.5%). The respondents were divided by two category of staffs which are academician (66.0%) and non-academician (34.0%). For the academician, most of the respondents were lecturer (84.8%) others were tutor, senior lecturer, associate professor and professor. For the non-academician staff, most of them were from the supporting staff (29.6%) while the remaining are professional and management staff (5.7%).

Both categories of the respondents were mostly permanent staff (89.9%), followed by temporary staff and contract staff with experience in UUM between 3-5 years (37.1%), 5-10 years (25.8%), 1-3 years (17.0%). They were also respondents with experience of more than 10 years and some with less than 1 year experience. Most of the respondents were between ages 21-30 (49.1%), followed by the respondents between ages 31-40 (39.6%) and others were between ages 41-50, below 20 and above 50. The respondents were dominantly from non-IT background (68.6%).

8. CONCLUSIONS, LIMITATIONS AND FUTURE RESEARCH

A. Conclusions

The objectives of this study are to identify the awareness and adoption of the current applications of university smart cards and finally to identify the users' preferences for future applications of university smart cards in order to optimize the adoption process. Overall, the objectives of this study have been achieved, where most of the respondents were aware of the smart card applications for both university applications and banking applications. Generally, they agreed that the smart card applications were not sufficient and agreed that university should continue and enhance other applications. PC login and security access were the application that respondents most preferred to be enhanced in the future smart card.

This study found that the rank of the awareness and adoption were identical for the same applications, whereby the attendance record and cash withdrawals are the applications that respondents are aware of and use the most. Nevertheless, referring to the mean of each application, even if the respondents are aware of those applications, they do not actually use or adopt those applications.

The study also found that university should have more promotion to the staffs on each application by promoting the function of the applications. Furthermore, those applications should be widely accepted not only in the university but also outside of the university. Security is one of the issues that respondents are concern of in using smart card applications, especially in banking applications. The smart card has to be reliable and secure to increase the trusty of the users.

B. Limitations

The findings and conclusion of this study are subject to several limitations. The scopes of this study only concentrate on the staff awareness and adoptions, although the use of the smart card applications is also implemented for the students. Due to the small number of samples and very limited to UUM staffs, this study could not be generalized in order to identify the awareness and adoption of university's smart card. Another limitation is regarding the factors of awareness and adoption of the smart card applications. This study is a descriptive study and only concentrates on which application that the respondents are most aware of and adopt, instead of what are the factors that influences users' awareness and adoption of the smart card applications.

C. Future Research

Perhaps in the future, a study could be done by including students as respondents to reveal their awareness and adoption as they are also the main user of the smart card applications. Besides that, a study can be done in other higher institutions, promoting the importance of the smart card applications. Future study should also be carried out with a more qualitative approach to identify the factors that influence the awareness and adoption and supported by any models to explain the adoption behaviour of smart card applications technology.

9. REFERENCES

[1] Adel Ismail Al-Alawi and Mohammed Ahmed Al-Amer. (2006). Young Generation Attitudes and Awareness Towards the Implementation of Smart Card in Bahrain: An Exploratory Study. *Journal of Computer Science,* 2 (5), 441-446.

[2] Adika Shiraz, A., & Noor Raihan, A. H. (2000). Development & Issues of Electronic Payment Systems in Malaysia: From the Service Providers' Perspective.

[3] Bull, B. (1999). Getting Smarter? Progressive Grocer, 78, 5, 131-132.

[4] Burbridge, L. (1998). Experience with the Use of a Multi-purpose Smart Card (No. 019): University of Exeter.

[5] Churchill Jr., G.A. (1999). Marketing Research: Methodological Foundations. *United States of America: The Dryden Press.*

[6] Clarke, R. (1998). Introduction to Chip-Cards and Smart Cards. On line (4 March 2004) http://www.anu.edu.au/people/Roger.Clarke/EC/ChipIntro.html

[7] Dillman, D.A (1978). *Mail and Telephone Surveys: The Total Design Method.* New York: John Wiley & Sons.

[8] Fowler D.C., Swatman P.M.C. and Welikala J. (2000) Issues Affecting the Implementation of Multiple Application Smart Card Systems, *"CollECTeR USA" -- 4th CollECTeR Conference on Electronic Commerce*, Breckenridge, Colorado, USA, April 11.

[9] Hui Min Lee, Catherine; Wing Cheng, Yuk; Depickere, Arnold (2003). Comparing Smart Card Adoption in Singapore and Australian Universities. *International Journal of Human-Computer Studies*, Volume 58 Issue 3, 307-325.

[10] Kaur, S. (2002). Card-Carrying on Campus**.** On line (30 September 2004) http://thestar.com.my/news/story.asp?file=/2002/7/21/education/sjsmarts&sec=education

[11] Kemier, A.M. (2002). Make the Grade with Smart Cards. *Business Forms, Labels & Systems*, 40, 5, 42-45.

[12] Lambrinoudakis, C. (2000). Smart Card Technology for Deploying a Secure Information Management Framework. *Information Management & Computer Security*, 8/4, 173-183.

[13] Lee, C.H.M, Cheng, Y.W., Depickere, A. (2003). Comparing Smart Card Adoption in Singapore and Australian Universities. *International Journal of Human-Computer Studies*, 58, 307-325.

[14] Leng, A.B. (1999). E-Commerce Card Capers. On line (31 October 2004) http://www.cio-asia.com/pcio.nsf/6eabcc3aca096d5448256b1700395a48?OpenForm&ParentUNID=54477A31DF640BC248256B4100355169

[15] Malar. S. Smart Card Application for Campus E-Services.

[16] Malhotra, N.K. (2004). *Marketing Research: An Applied Orientation*. Prentice Hall: USA.

[17] Peterson, A.H. (1999). Waiting for Smart Card. *Credit Union Magazine,* Jul 1999, 65, 7, 54-57.

[18] Ronay, A., & Lavelle, T. (2001). Smart Card Technology in the Asia Pacific Rim: Smart Card New Ltd.

[19] Sekaran, U. (2003). *Research Methods for Business-A Skill Building Approach.* 4th Ed. United State: John Wiley & Sons, Inc.

[20] Taneja, S., (1999). A Degree of Acceptance. *Chain Store Age,* Apr 1999, 94

[21] Trask, N.T., & Meyerstein, M.V. (1999). Smart Cards in Electronic Commerce. *BT Technology Journal,* Jul 1999, 17, 3, 57-65.

[22] Wang, Q. and Cheng, L. (2004) A Flexible Awareness Measurement and Management Architecture for Adaptive Applications, *IEEE Communications Society*, 2118-2122.

[23] Welikala J., Fowler D.C. and Swatman P.M.C. (1997) Introducing Multi-purpose, Multi-function Smart Cards to Australian Universities, *"CollECTeR'97" -- 1st Annual CollECTeR Workshop on Electronic Commerce,* Adelaide, October 3rd, 104-112.

[24] Zalud, B.(2000). New Smart Cards, But Still Old Door Controls. *Security*, March 2000, 65.

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